Claims

1. A method of obtaining a tomographic image of part of an animal or a part of an animal including a human being or a part of a human being by using radioactive radiation, wherein the animal is at least partly placed into a measuring cavity having an axial axis, the measuring cavity being at least partially surrounded by a cavity wall which is provided with a plurality of pinholes, and wherein behind the pin holes (as viewed from the measuring cavity or lumen) detection means are placed, radioactive radiation from a radioactive isotope administered to the animal is detected in a position-related manner by the detection means and data obtained with the detection means are used for the generation of the tomographic image, characterised in that:

- the pinholes are at least substantially arranged in a plurality of flat planes which planes are at least substantially parallel and separated in the direction of the axial axis relative to each other wherein the distance between neighbouring planes is smaller than the distance between neighbouring pinholes within such a plane; or

- the pinholes are at least substantially arranged along a helix wherein the pitch of the helix is generally smaller than the distance between neighbouring pinholes laying on the helix.

2. An apparatus for obtaining a tomographic image of a human being or part of a human being or an animal or a part thereof using radioactive radiation, which apparatus comprises a measuring cavity having an axial axis, a cavity wall which at least partly surrounds the measuring cavity which cavity wall is provided with a plurality of pinholes, the apparatus further comprising detection means which viewed from the cavity, are provided behind the pin holes, wherein the detection means are arranged for receiving, in a position-related manner, the radioactive radiation emitted within the

measuring cavity and wherein the detection means can be read electronically or optically, characterised in that:

-the pinholes are at least substantially arranged in a plurality of flat planes which planes are at least substantial parallel and separated in the direction of the axial axis relative to each other wherein the distance between neighbouring planes is smaller than the distance between neighbouring pinholes within any of such planes; or

-the pinholes are substantially arranged along a helix wherein the pitch of the helix is generally smaller than the distance between neighbouring pinholes laying on the helix.

3. An apparatus according to claim 2 , characterised in that distance between neighbouring planes is at least 1.03, at least 1.05, at least 1.3, more specifically at least 2, preferably at least 5 or more preferably a least 10 times smaller than the distance between neighbouring pinholes within any of such planes; or the pitch of the helix is generally at least 1.03, at least 1.05, at least 1.3, more specifically at least 2, preferably at least 5 or more preferably at least 10 times smaller than the distance between neighbouring pinholes laying along the helix.

4. An apparatus according to claim 2 or 3, characterised in that the cavity wall is of a rotationally symmetrical design around the axial axis of the measuring cavity.

5. An apparatus according to claim 4, characterised in that the cavity wall has a shape of a cylinder.

6. An apparatus according to claim 4, characterised in that the cavity wall has a polygonal cross section in a direction perpendicular to the axial axis.

7. An apparatus according to claim 6, characterised in the polygonal cross section comprises n angles (n greater than or equal to 3).

8. An apparatus according to any preceding claim 2-7, characterised in that the cavity wall comprises a number of at least substantially flat wall segments having the pinholes.

9. An apparatus according to claims 7 and 8, characterised in that the cavity wall comprises n wall segments.

10. An apparatus according to claim 7 or 8, characterised in that the wall segments have a rectangular shape.

11. An apparatus according to any preceding claim 7-10, characterised in that pinholes that are located relatively close to the ribs of the polygonal measuring cavity are at an angle to the normal of the wall segment, thereby pointing in the direction of the axial axis.

12. An apparatus according to any preceding claim 7-11, characterised in that the distance between two neighbouring pinholes laying in one of said planes or on said helix and laying relatively close to one of the ribs of the polygonal measuring cavity is greater than the distance between two neighbouring pinholes laying in the one of said planes or on said helix and laying substantially in the middle between two adjacent ribs.

13. An apparatus according to one of the claims 7-12, characterised in that respective pinholes situated nearer the axial ends of the measuring cavity are at an angle to the normals of the wall segment near the respective pinholes thereby at least substantially pointing in the direction of the absolute center of the measuring cavity or in the direction of a line segment at least substantially extending through the absolute center of the measuring cavity in the direction of the axial axis wherein said line segment is substantially shorter than the length of the measuring cavity in the direction of the axial axis , for example shorter than 50%, preferably shorter than 30% and more preferably shorter than 15% of the length of the measuring cavity in the direction of the axial axis.

14. An apparatus according to any preceding claim 8-13, characterised in that an edge directed in the axial direction of at least one of the wall segments is adjacent to a selectable portion of a neighbouring wall segment said portion being directed in the direction of the axial axis and being directed to the measuring cavity so that the diameter of the measuring cavity

can be varied by selecting the distance between said portion of said neighbouring wall segment and an edge directed in the direction of the axial axis of said neighbouring wall segment and/or that the detection means comprises a plurality of substantially flat detectors wherein an edge directed in the direction of the axial axis of at least one of the detectors is adjacent to a selectable portion of a neighbouring detector said portion being directed in the direction of the axial axis and being directed to the measuring cavity so that the diameter of a cavity formed by the detectors can be varied by selecting the distance between said portion of said neighbouring wall detector and an edge directed in the direction of the axial axis of said neighbouring detector.

15. An apparatus according to any preceding claim 2-14, characterised in that wherein the apparatus is further provided with radiation blocking means which partly block radiation which travels from the measuring cavity through at least one of the pinholes to the detection means such that the radiation which is detected by the detection means lays in a limited solid angle relative to the at least one pinhole, which angle is smaller than the solid angle which would have been obtained without the radiation blocking means.

16. An apparatus according to claim 15, characterised in that the detection means comprises a plurality of detector arrays wherein the radiation blocking means are arranged such that each detection array only receives radiation coming from one of the pinholes.

17. An apparatus according to claim 15 or 16, characterised in that the radiation blocking means comprises baffles.

18. An apparatus according to claim 17, characterised in that the baffles are located inside the measuring cavity.

19. An apparatus according to claim 18, characterised in that the baffles are located adjacent the cavity wall.

20. An apparatus according to claim 17, characterised in that the baffles are located outside the measuring cavity.

21. An apparatus according to claim 20, characterised in that the baffles are arranged between the cavity wall and the detection means.

22. An apparatus according to claim 21, characterised in that the baffles are adjacent the cavity wall.

23. An apparatus according to claim 21, characterised in that the baffles are adjacent the detection means.

24. An apparatus according to any preceding claim 17-23, characterised in that, the baffles each lay substantially in a plane through said axial axis.

25. An apparatus according to one of the claims 17-24, characterised in that the baffles are provided with projecting elements having a direction component parallel to a surface of the detection means.

26. An apparatus according to claim 15 or 16 characterised that the radiation blocking means comprise a blocking wall extending between the cavity wall and the detection means wherein said blocking wall comprises a plurality of openings for providing a passage for the radiation from the pinholes to the detection means laying within said limited solid angle.

27. An apparatus according to claim 26, characterised in that the openings of the blocking wall have a surface which is greater than the surface of the pinholes.

28. An apparatus according to claim 26 or 27, characterised in that each opening of the blocking wall corresponds with one of the pinholes such that the radiation which passes through one of the openings comes from a single one of the pinholes.

29. An apparatus according to any preceding claim 26-28, characterised in that the blocking wall has a shape which is substantially similar to the shape of the cavity wall.

30. An apparatus according to any preceding claim 26-29, characterized in that the blocking wall comprises at least substantially flat wall segments having the openings wherein an edge directed in the direction of

the axial axis of at least one of the wall segments is adjacent to a selectable portion of a neighbouring wall segment said portion being directed in the direction of the axial axis and being directed to the measuring cavity so that the diameter of a space which is at least partly surrounded by the blocking wall and which space comprises the measuring cavity can be varied by selecting the distance between said portion of said neighbouring wall segment and an edge directed in the direction of the axial axis of said neighbouring wall segment.

31. An apparatus according to any of the claims 26-30, characterised in that the blocking wall is of a rotationally symmetrically design around the axial axis of the measuring cavity.

32. An apparatus according to claim 31, characterised in that the blocking wall has a polygonal cross section in a direction perpendicular to the axial axis.

33. An apparatus according to claim 32, characterised in the polygonal cross section comprises n angles (n greater than or equal to 3).

34. An apparatus according to claim 33, characterised on that the blocking wall comprises n wall segments and/or that the detection means comprises n detectors.

35. An apparatus for obtaining a tomographic image of a human being or part of a human being or an animal or a part thereof using radioactive radiation, which apparatus comprises a measuring cavity having an axial axis, a cavity wall which at least partly surrounds the measuring cavity which cavity wall is provided with a plurality of pinholes, the apparatus further comprising detection means which viewed from the cavity, are provided behind the pinholes, where the detection means are arranged for, in a position-dependent manner, the detection of radioactive radiation emitted within the measuring cavity and the detection means can be read electronically or optically, characterised in that, the cavity wall comprises at least substantially flat wall segments having the pinholes wherein an edge directed in the

direction of the axial axis of at least one of the wall segments is adjacent to a selectable portion of a neighbouring wall segment said portion being directed in the direction of the axial axis and being directed to the measuring cavity so that the diameter of the measuring cavity can be varied by selecting the distance between said portion of said neighbouring wall segment and an edge directed in the direction of the axial axis of said neighbouring wall segment and/or that the detection means comprises a plurality of substantially flat detectors wherein an edge directed in the direction of the axial axis of at least one of the detectors is adjacent to a selectable portion of a neighbouring detector said portion being directed in the direction of the axial axis and being directed to the measuring cavity so that the diameter of a cavity formed by the detectors can be varied by selecting the distance between said portion of said neighbouring wall detector and an edge directed in the direction of the axial axis of said neighbouring detector.

36. An apparatus according to claim 35, characterised in that the cavity wall is of a rotational symmetrical design around the axial axis of the measuring cavity.

37. An apparatus according to claim 36, characterised in that the cavity wall has a polygonal cross section in a direction perpendicular to the axial axis.

38. An apparatus according to claim 37, characterised in the polygonal cross section comprises n angles (n greater than or equal to 3).

39. An apparatus according to claim 38, characterised on that the cavity wall comprises n wall segments and/or that the detection means comprises n detectors.

40. An apparatus according to claim 37-39, characterised in that pinholes that are located nearer the ribs of the polygonal measuring cavity are at an angle to the normal of the wall segment in the direction of the axial axis.

41. An apparatus according to any claim 37-40, characterised in that pinholes laying substantial in a plane perpendicular to the axial axis and

being near one of the ribs of the polygonal measuring cavity are spaced further apart than pinholes laying substantial in the plane perpendicular to the axial axis and laying substantial in the middle between two adjacent ribs.

42. An apparatus according to any claim 35-41, characterised in that pinholes situated relatively close to the axial ends of the measuring cavity are at an angle to the normal of the wall segment in the direction of the absolute centre of the measuring cavity.

43. An apparatus according to any preceding claim 35-42, characterised in that the wall segments have a rectangular shape.

44. An apparatus for obtaining a tomographic image of a human being or part of a human being or an animal or a part thereof using radioactive radiation, which apparatus comprises a measuring cavity which may have an axial axei, a cavity wall which may at least partly surround the measuring cavity which cavity wall is provided with a plurality of pinholes, the apparatus further comprising detection means which viewed from the measuring cavity, are provided behind the pin holes, wherein the detection means are arranged for in a position-dependent manner the detection of radioactive radiation emitted within the measuring cavity wherein the detection means can be read electronically or optically, characterised in that the apparatus is further provided with radiation blocking means which partly block radiation which travels from the measuring cavity through at least one of the pinholes to the detection means such that the radiation which is detected by the detection means lays in a limited solid angle relative to the at least one pinhole, which angle is smaller than the solid angle which would have been obtained without the radiation blocking means.

45. An apparatus according to claim 44, characterised in that the detection means comprise a detector arrays wherein the radiation blocking means are arranged such that each detector array only receives radiation coming from one of the pinholes.

46. An apparatus according to claim 44 or 45, characterised in that the radiation blocking means comprises baffles.

47. An apparatus according to claim 46, characterised in that the baffles are located inside the measuring cavity.

48. An apparatus according to claim 47, characterised in that the baffles are located adjacent the cavity wall.

49. An apparatus according to claim 46, characterised in that the baffles are located outside the measuring cavity.

50. An apparatus according to claim 49, characterised in that the baffles are arranged between the cavity wall and the detection means.

51. An apparatus according to claim 50, characterised in that the baffles are adjacent the cavity wall.

52. An apparatus according to claim 50, characterised in that the baffles are adjacent the detection means.

53. An apparatus according to any preceding claim 46-52, characterised in that, the baffles each lay substantially in a plane through said axial axis.

54. An apparatus according to one of the claims 46-53, characterised in that the baffles are provided with projecting elements having a direction component parallel to the surface of the detection means.

55. An apparatus according to claim 44 or 45, characterised that the radiation blocking means comprise a blocking wall extending between the cavity wall and the detection means wherein said blocking wall comprises a plurality of openings for providing a passage for the radiation from the pinholes to the detection means laying within said limited solid angle.

56. An apparatus according to claim 55, characterised in that the openings of the blocking wall have a surface which is greater than the surface of the pinholes.

57. An apparatus according to claim 55 or 56, characterised in that each opening of the blocking wall corresponds with one of the pinholes such

that the radiation which passes through one of the openings comes from a single one of the pinholes.

58. An apparatus according to any preceding claim 55-57, characterised in that the blocking wall has a shape which is substantially similar to the shape of the wall of the measuring cavity.

59. An apparatus according to any preceding claim 55-58 characterized in that the blocking wall comprises at least substantially flat wall segments having the openings wherein an edge directed in the axial direction of at least one of the wall segments is adjacent to a selectable portion of a neighbouring wall segment said portion being directed in the direction of the axial axis and being directed to the measuring cavity so that the diameter of a space which is at least partly surrounded by the blocking wall and which space comprises the measuring cavity can be varied by selecting the distance between said portion of said neighbouring wall segment and an edge directed in the direction of the axial axis of said neighbouring wall segment.

60. An apparatus according to any of the claims 55-59, characterised in that the blocking wall is of a rotationally symmetrical design around the axial axis of the measuring cavity.

61. An apparatus according to claim 60, characterised in that the blocking wall has a polygonal cross section in a direction perpendicular to the axial axis.

62. An apparatus according to claim 61, characterised in the polygonal cross section comprises n angles (n greater than or equal to 3).

63. An apparatus according to claim 62, characterised in that the blocking wall comprises n wall segments and/or that the detection means comprises n detectors.

64. An apparatus according to one of the claims 44-63, characterised in that the measuring cavity has a polygonal cross section in a direction perpendicular to the axial axis and the cavity wall comprises at least substantially flat wall segments having the pinholes.

65. An apparatus according to claim 64, characterised in that pinholes that are located nearer the ribs of the polygonal measuring cavity are at an angle to the normal of the wall segment in the direction of the axial axis.

66. An apparatus according to claim 64 or 65, characterised in that neighbouring pinholes laying substantial in a plane perpendicular to the axial axis and being near one of the ribs of the polygonal measuring cavity are spaced further apart than neighbouring pinholes laying substantial in the plane perpendicular to the axial axis and laying substantial in the middle between two adjacent ribs.

67. An apparatus according to one of the claims 64-66 characterised in that pinholes situated relatively close to the axial ends of the measuring cavity are at an angle to the normal of the wall segment in the direction of the absolute centre of the measuring cavity.

68. An apparatus according to one of the claims 2-67, characterised in that the pinholes are distributed over the wall of the measuring cavity such that for two peripherally neighbouring pinholes (pinholes separated in a direction perpendicular to the axial axis) one axially neighbouring pinhole is situated halfway 50± 20% between the two peripheral neighbouring pinholes.

69. An apparatus according to one of the claims 2 to 68, characterised in that the pinhole is rectangular.

70. An apparatus according to one of the claims 2 to 69, characterised in that a detection means placed behind a pinhole is a detector array.

71. An apparatus according to one of the preceding claims 2-70, characterised in that a detection means Di situated behind a pinhole Pi comprises at least two detection means segments placed at an angle in relation to one another and out of plane, such that radiation from pinhole Pi reaching the detection means segment will on average have a more perpendicular line of incidence than if they were placed in a plane wherein i= 1, 2, 3, ...n wherein n is the total number of pinholes.

72. An apparatus according to one of the preceding claims 2-71, characterised in that a detection means Di situated behind a pinhole Pi has a curved surface, such that the radiation from pinhole Pi will on average have a more perpendicular line of incidence onto each part of the detection means Di wherein i= 1, 2, 3, ...n wherein n is the total number of pinholes.

73. A method of obtaining a tomographic image of a human being or part of a human being or an animal or a part of an animal by using radioactive radiation, wherein the animal is at least partly placed into a measuring cavity, the measuring cavity possesses a wall which is provided with a plurality of pinholes, behind the pinholes (as viewed from the lumen of the measuring cavity) detection means D are placed, radioactive radiation from a radioactive isotope administered to the animal is detected in a position-dependent manner by the detection means D, and data obtained with the detection means D are used for the generation of the tomographic image, characterised in that a measuring cavity is used comprising an array of pinholes, wherein an arbitrary first pinhole P_1 in a substantially axial direction in relation thereto has a nearest neighbouring pinhole P_2, and in a substantially transversal direction has a nearest neighbouring third pinhole P_3, the axial component of the distance between first and second pinholes P_1 and P_2, respectively, being smaller than the transversal component of the distance between the first and third pinholes P_1 and P_3, respectively, and in that means are provided to limit the chance that via pinhole Pi radiation reaches any detection means D other than detection means Di.

74. An apparatus for obtaining a tomographic image of a human being or part of a human being or an animal or a part thereof using radioactive radiation, which apparatus comprises a measuring cavity provided with a plurality of pinholes, the measuring cavity being arranged to at least partly surround the animal where, viewed from the lumen, detection means D are provided behind the pin holes, where the detection means D are suitable for in a position-dependent manner detecting radioactive radiation and that the

detection means D can be read electronically or optically, characterised in that the wall of the measuring cavity possesses an array of pinholes, wherein the axial component of the distance between two in axial direction neighbouring pinholes is smaller than the transversal component of the distance between two neighbouring pinholes located in transversal direction with respect to the axial direction, in that a pinhole P_1 has a maximum angle of incidence αi with respect to the normal and a detection means Di located behind that pinhole, and in that means are provided to limit the chance that via pinhole Pi radiation reaches any detection means D other than detection means Di.

75. An apparatus according to claim 74 characterised in that the means comprise baffles.

76. An apparatus according to claim 75, characterised in that the baffles are oriented towards the lumen of the measuring cavity.

77. An apparatus according to claim 75 or 76, characterised in that the baffles are mounted on, around, or up against the surface of the detection means.

78. An apparatus according to one of the claims 74-77, characterised in that the baffles are provided with projecting elements having a direction component parallel to the surface of the detection means.

79. An apparatus according to one of the claims 74-78, characterised in that the pinholes are distributed over the wall of the measuring cavity such that for two peripherally neighbouring pinholes one axially neighbouring pinhole is situated halfway ±20% between the two peripheral neighbouring pinholes.

80. An apparatus according to one of the claims 74-79, characterised in that the pinhole is rectangular.

81. An apparatus according to one of the claims 74-80, characterised in that a detection means placed behind a pinhole is a detector array.

82. An apparatus according to one of the claims 74-81, characterised in that the measuring cavity has a polygonal cross section and the wall is divided into wall segments having pinholes.

83. An apparatus according to claim 82, characterised in that pinholes that are located nearer the ribs of the polygonal measuring cavity are at an angle to the normal of the wall segment in the direction of the centre line of the polygonal measuring cavity.

84. An apparatus according to claim 82, characterised in that pinholes near one of the ribs of the polygonal measuring cavity are spaced further apart than pinholes nearer to the middle between two adjacent ribs.

85. An apparatus according to one of the claims 74-84, characterised in that pinholes situated nearer the axial ends of the measuring cavity are at an angle to the normal of the wall segment in the direction of the absolute centre of the measuring cavity.

86. An apparatus according to one of the claims 74-85, characterised in that at least 3 transversally spaced from one another and axially nearest neighbouring pinholes Pi are axially staggered in relation to one another.

87. An apparatus according to one of the preceding claims 74-86, characterised in that a detection means Di situated behind a pinhole Pi comprises at least two detection means segments placed at an angle in relation to one another and out of plane, such that radiation from pinhole Pi reaching the detection means segment will on average have a more perpendicular line of incidence than if they were placed in a plane.

88. An apparatus according to one of the preceding claims 74-87, characterised in that a detection means Di situated behind a pinhole Pi has a curved surface, such that the radiation from pinhole Pi will on average have a more perpendicular line of incidence onto each part of the detection means Di.

89. An apparatus according to any preceding claims 2-88, characterized in that, the cavity wall may be arranged to be replaceable by another cavity

wall comprising other dimensions and/or other patterns of pinholes and/or pinholes with other dimensions.

90. An apparatus according to any preceding claims 26-34 or 55-63, characterized in that, the blocking wall may be arranged to be replaceable by another blocking wall comprising other dimensions and/or other patterns of openings and/or openings with other dimensions.

91. An apparatus according to claim 3, characterised in that, the distance between neighbouring planes is not smaller than 0.03 and preferably 0.05 times the distance between neighbouring pinholes within any of such planes.

92. An apparatus according to claim 2, characterised in that the distance between neighbouring planes is 0.03-0.98 and more preferably 0.05-0.77 times the distance between neighbouring pinholes within any of such planes.

93. An apparatus according to claim 3, characterised in that, the pitch of the helix is not smaller than 0.03 and preferably 0.05 times the distance between neighbouring pinholes laying on the helix.

94. An apparatus according to claim 2, characterised in that, the pitch of the helix is 0.03-0.98 and more preferably 0.05- 0.77 times the distance between neighbouring pinholes laying on the helix.

95. An apparatus according to any of the claims 17-25 or 46-54 or 75-78, characterised that at least one of the baffles is retractable so that, in use, the retracted baffle will not be illuminated by the radiation from the cavity.